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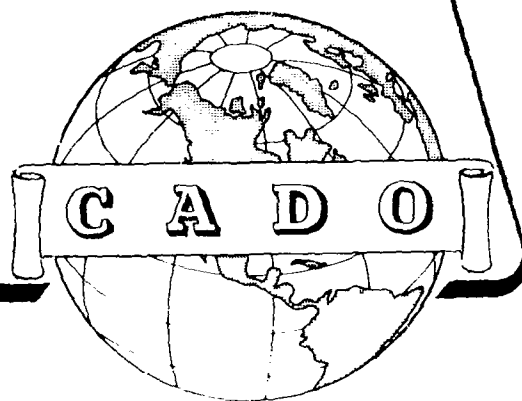
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49153

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Wing-Trailing Edge Skin Panels-Static Tests, Conducted 1 Jan thru 1 June 1945
Model XB-36 & YB-36A

49153

Whetstone, M. R.; Robinson, J. F.

(None)

Consolidated Vultee Aircraft Corp., Fort Worth Div., Texas
(Same)

FSG-136 & Add.1

(Same)

Feb' 46 Unclass. U.S. English 25 photos, tables, diagr

Six metalbonded wing-trailing edge skinpanels - as designed for the XB-36 bomber, and of different materials and sections were subjected to static tests. Five specimens were tested as simple beams and found unsatisfactory. The sixth specimen (Waffle, 36W2345) was tested under conditions simulating those on the subject airplane and found satisfactory. Although it crippled at the bend at 86% design load, it showed no permanent set at yield load, and continued to carry load above 114% design ultimate load.

Copies of this report obtainable from CADO

(1)

Structures (7)

Wings - Structural tests (99192);

Design and Details (3)

Panels, Flat (68743.05); XB-36 (99409)

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XB-36
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FSG-136
February 7, 1946

WING - TRAILING EDGE SKIN PANELS -
STATIC TEST

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CONSOLIDATED VULTEE AIRCRAFT CORPORATION
FORT WORTH DIVISION • FORT WORTH 1, TEXAS



TEST NO. F-855 & 1122
MODEL XB-36

REPORT FSG-136 + Add^{#1}
DATE February 7, 1946

TITLE

WING - TRAILING EDGE SKIN PANELS - STATIC TESTS

The tests described in this report were conducted from
1-1-45 through 6-1-45.

SUBMITTED UNDER

M. R. Whetstone

PREPARED BY:

GROUP: ENGINEERING LABORATORY

REFERENCE:

CHECKED BY:

APPROVED BY: *R. S. Reade*

APPROVED BY: *W. P. [Signature]*

NO. OF PAGES 17

NO. OF DIAGRAMS 13

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WING - TRAILING EDGE SKIN PANELS - STATIC TESTS

REFERENCES:

CVAC REPORTS - FSG-069 - Wing - T.E. Skin Panel - Overlapping
Hats - Static Test
FSG-071 - Wing - T.E. Skin Panel - Round hole
Grid - Static Tests

CVAC DRAWINGS 36FTW150 T.E. Skin Panels
36W2345
36W1700 - Wing - T.E. Installation
36W1800 - Wing - T.E. Installation
36W1807 - Wing - T.E. Beam
36W1015 - Wing - T.E. Bulkhead
36W1014 - Wing - T.E. Rib

PURPOSE:

The "trailing edge" of the wing, comprising all that portion of the surface aft of the 43% line, is composed of 13" wide panels supported by chordwise beams and ribs. For the sake of aerodynamic smoothness, it is proposed that this area be skinned by means of stiffened panels, in which the stiffening elements are cemented or Metlbonded to the skin. Two types of panels having been previously tested (FSG-069 and 071) it appears desirable to test a series of six additional panels.

SUMMARY:

Six metlbonded specimens of different materials and sections were tested. Five specimens were tested as simple beams and were found unsatisfactory. The sixth specimen (Waffle, 36W2345) was tested under conditions simulating those on the airplane and was found satisfactory. Although specimen #6 crippled at the bead at 86% design ultimate load, it showed no permanent set at yield load, and continued to carry load above 114% design ultimate load.

WING - TRAILING EDGE SKIN PANELS - STATIC & DEFLECTION TESTS

OBJECT:

To test several types of proposed trailing edge panels and select a panel with an optimum strength-weight ratio.

DESCRIPTION OF SPECIMENS:

The descriptions of the specimens are tabulated below (Table I) with figure numbers for reference.

TABLE I

SPECIMEN NO.	TYPE	MAG. SKIN GAGE	MAG. GRID GAGE	PHOTO #
1 36FTW150	Rect. Hole 6.3# Cellulose Filler	.016	.016	1
2	Rect. Hole Chrysler Balsa Filler	.016	.016	2
3	Beam - 3.5# Cellulose Filler	.016	.016	3
4	Beam - Mag. Hat	.016	.020	4
5	Waffle - Small Section	.016	.016 Alclad	5
6 36W2345	Waffle - Full Panel	.016	.016 Alclad	6
7	Waffle - Full Panel	.016	.016 Alclad	Test #F-398 FSG-071

Specimens #1 to #5 inclusive are similar in size to specimen drawing 36FTW150, Figure 7. A photograph of the drawing 36W2345 for specimen #6 is shown in Figure 8a & 8b. All specimens were wetbonded.

SET UP & PROCEDURE:

Specimens 1 to 5 inclusive were tested as simple beams. The sides of the specimens were riveted to steel angles which were restrained in a vertical direction only.

February 7, 1946

Increments of the design ultimate uniform pressure of 2.2 psi were applied to the skin side with rubber tension patches cemented to the surface. Deflection gages were placed on the grid side of the specimen, and were read at 10% increments.

The sixth specimen, a full waffle panel, was tested in a jig which simulated the actual conditions in the airplane. A photograph of the test set up is shown in Fig. 9. The long edges of the waffle were riveted to Y36A85T80 Zee sections as in the airplane, and the zee's were supported by short beams; rear spar attachments, & neighboring waffle skins, all simulating actual conditions; the neighboring panels were not loaded. The trapezoidal load distribution imposed by Low Angle of Attack, $V_i = 318$ (Fig. 10), was applied with rubber tension patches. Deflections were read as on the previous tests.

RESULTS AND DISCUSSION:

The results of the tests are shown in Table II below:

TABLE II

<u>SPECIMEN</u> <u>#</u>	<u>DESIGN</u> <u>ULTIMATE</u> <u>LOAD</u>	<u>%</u> <u>FAILURE</u>	<u>TYPE</u> <u>FAILURE</u>	<u>FIG. #</u>
1	2.2 PSI Uniform	142	Crippling Grid	1
2	2.2 PSI Uniform	62	Bond or Grid	2
3	"	50	Crippling Grid	3
<u>Note:</u> Filler was crushed in bonding				
4	2.2 PSI Uniform	60	Collapsed Walls of Hats at End Connections	4
5	"	64	Crippling Bead	5
6	2.2 - 1.4 Distributed	86	Crippled Bead	6
<u>Note:</u> Specimen Continued to take load above 114%				
7	2.2 PSI Uniform	109 370	Crippled Bead Failed	Test #F-398 FSG-071

Although specimen #1 showed the required strength, its weight prohibited its use on the airplane.

Because of the increase in strength shown between specimens #5 and #6 with a change in the test set up, it is conceivable that specimens 2, 3, & 4 could be of sufficient strength; however, these three specimens are undesirable for other reasons such as moisture absorption, fragility, etc.

Since no permanent set was obtained in specimen #6 at yield load, and since the specimen continued to take load over 100% design ultimate load, the specimen appears satisfactory in strength.

A deflection curve of each specimen is shown in Fig. 11.

CONCLUSIONS:

A comparison between test #F-398, FSG-071 (curve #7 Fig.11) in which the waffle was rigidly supported on the sides, and the two tests (specimens #5 & 6) shown in this report (curves #5 & 6, Fig.11) shows that the panel on the airplane neither acts as a simple beam nor as a catenary, but as a compromise of the two.

The "waffle" consisting of .016 alclad grid (36W2345) bonded to .016 magnesium skin, having successfully withstood more than the design ultimate air loads, is considered structurally satisfactory for use as a trailing edge skin panel.

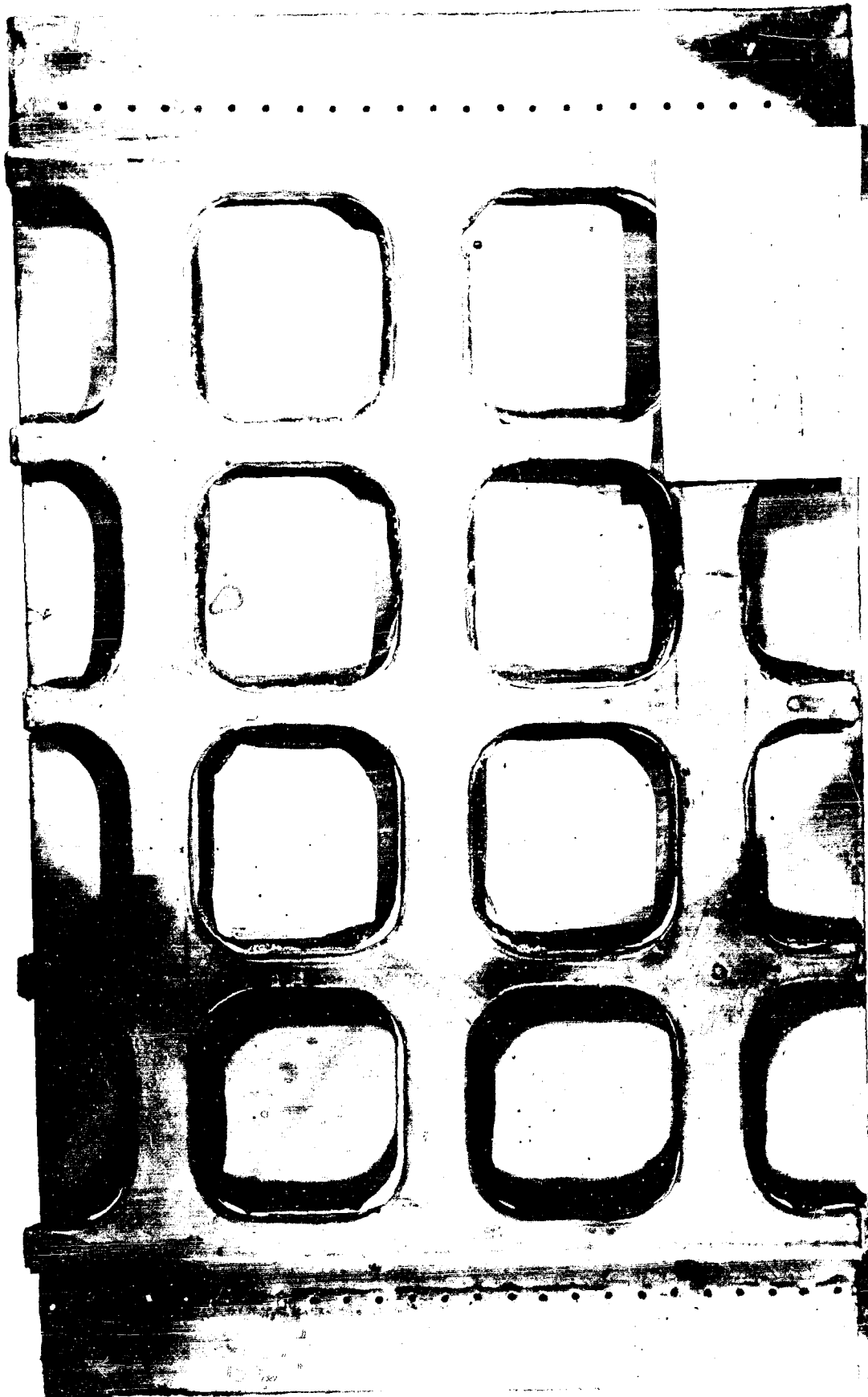


Fig. 1



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FORT WORTH DIVISION FORT WORTH, TEXAS
ENGINEERING DEPARTMENT

STRUCTURAL SECTION

Test #1-885 Model YE-36 Report No. FSG-116

WING - J. E. SKIN PANEL - RECT. HOLE GRID -
STATIC AND DRILL TESTS FAILURE AT 624

Test Engineer: C. R. Whitcomb 10-27-44

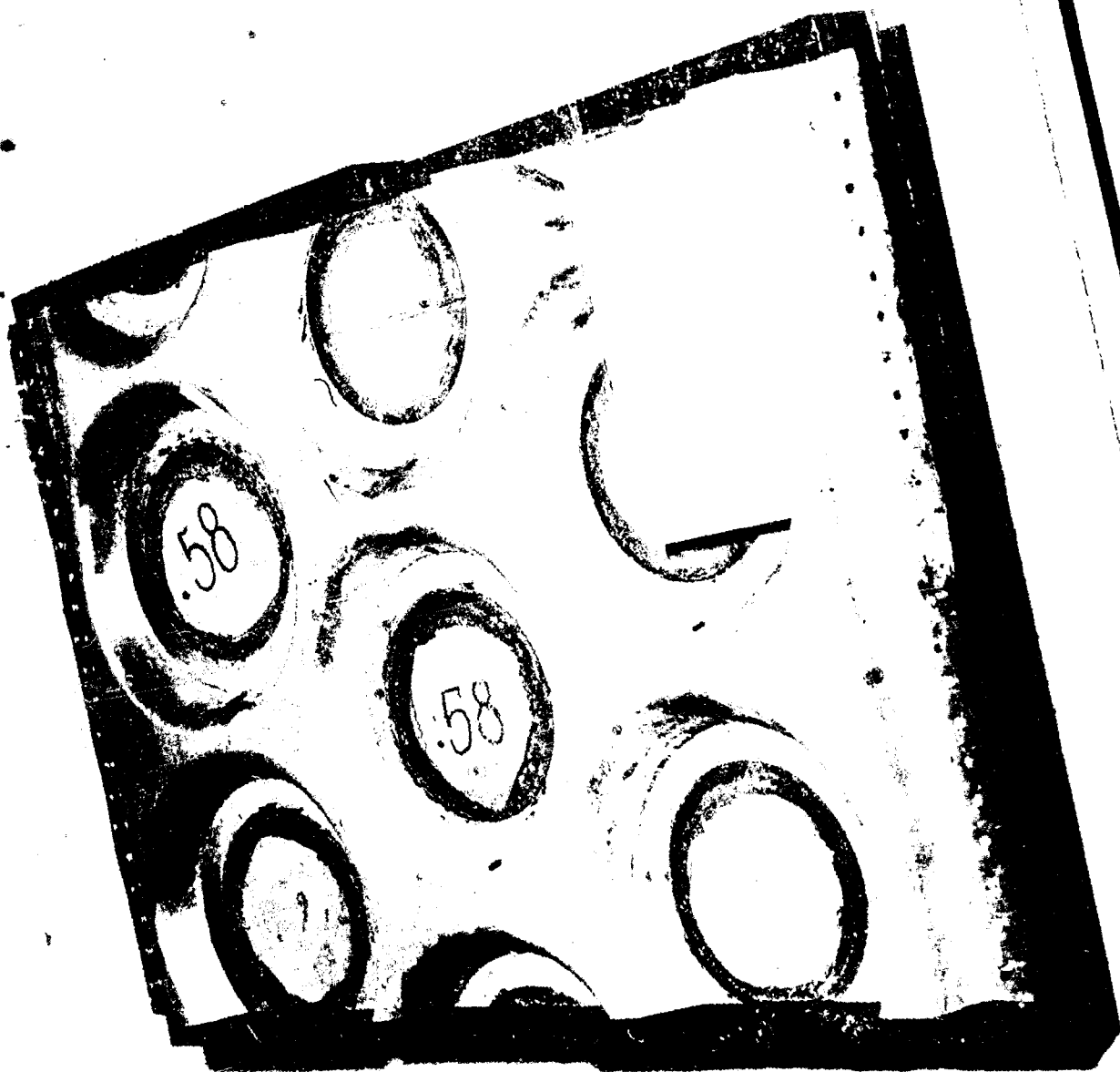
FIG. 2



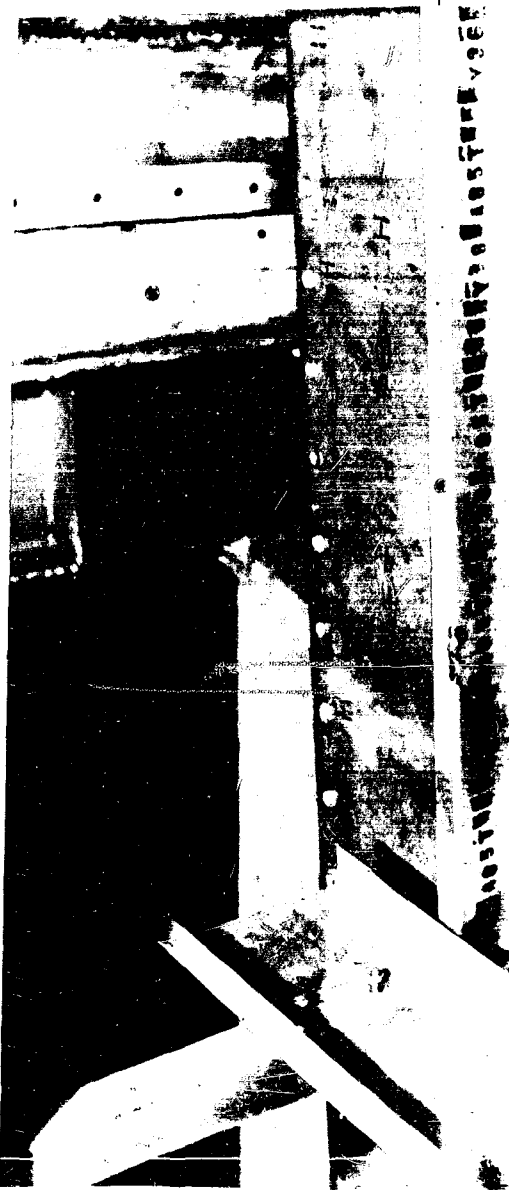
F. 12.3



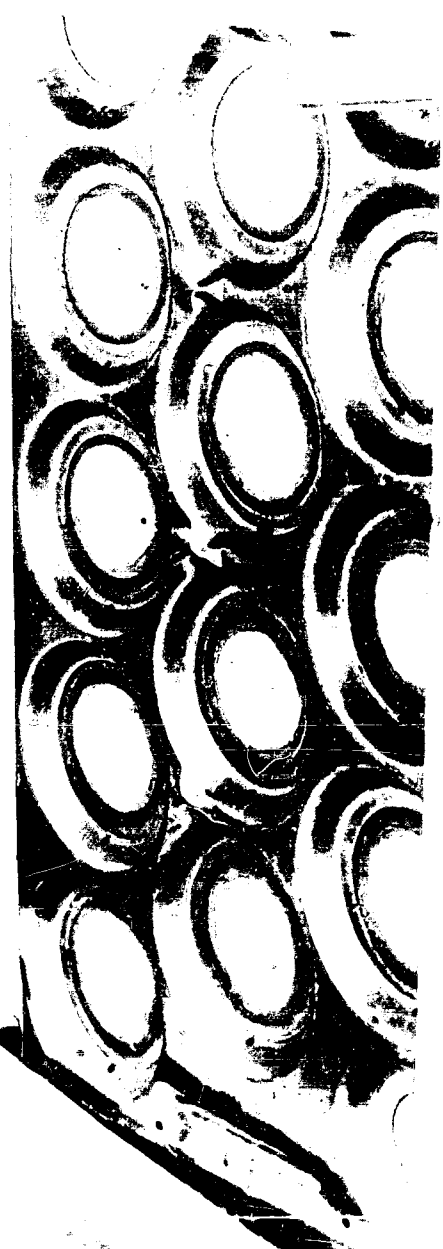
Fig. 4



1-12-5

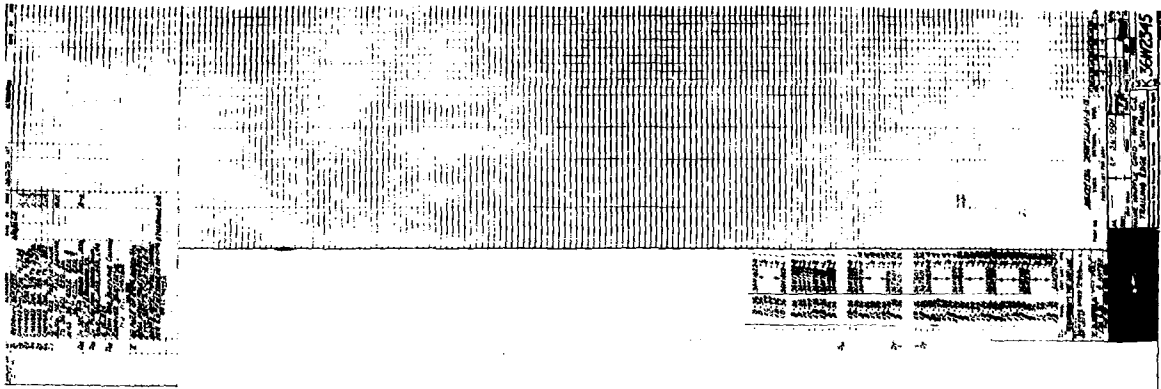


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2-4958 6-1-45
WING-T. E. PANEL-FAILURE AT
86% DUL. CVAC. FT. WORTH TEX

FIG. 4



APPROX. 0.125 IN.

③ 100% OF THE TOTAL WEIGHT OF THE PART IS TO BE MADE OF 304 STAINLESS STEEL

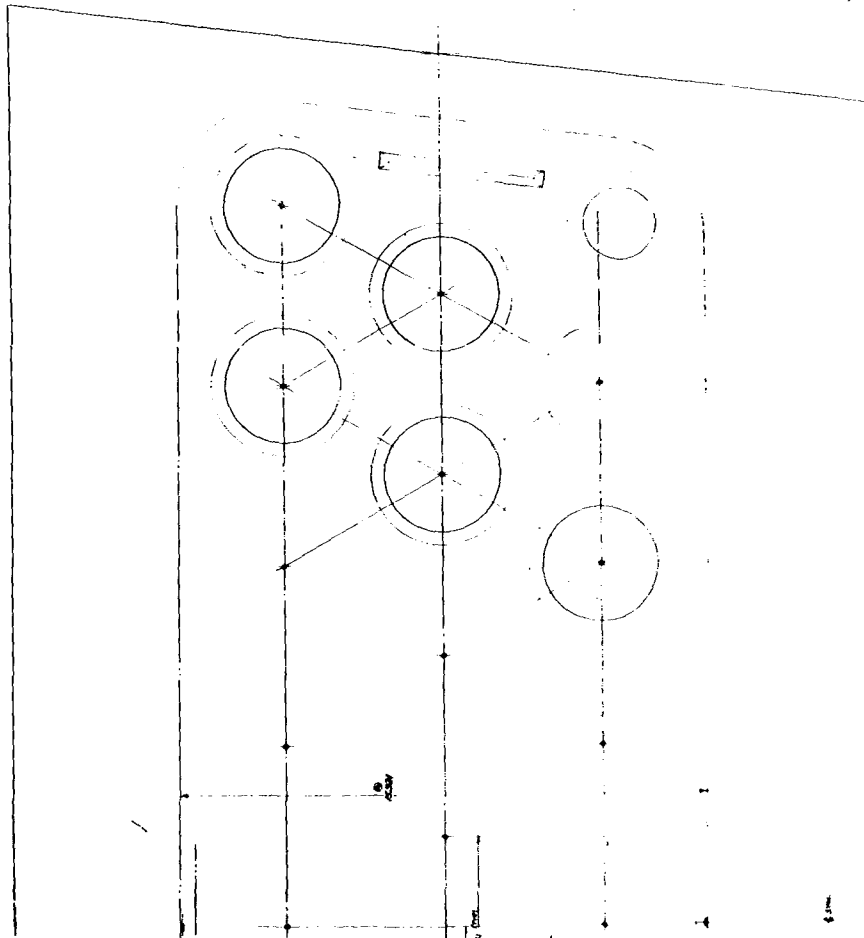
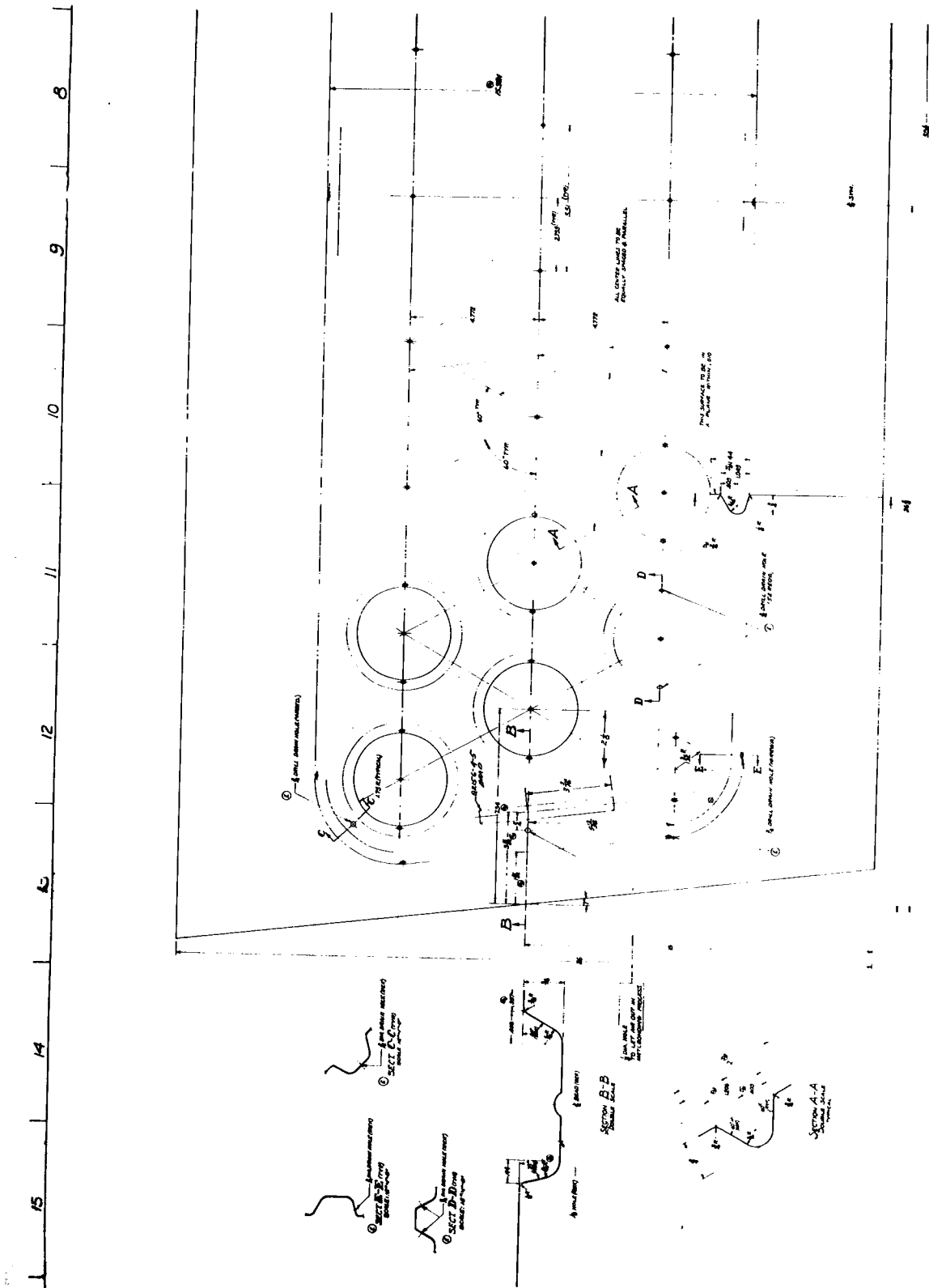
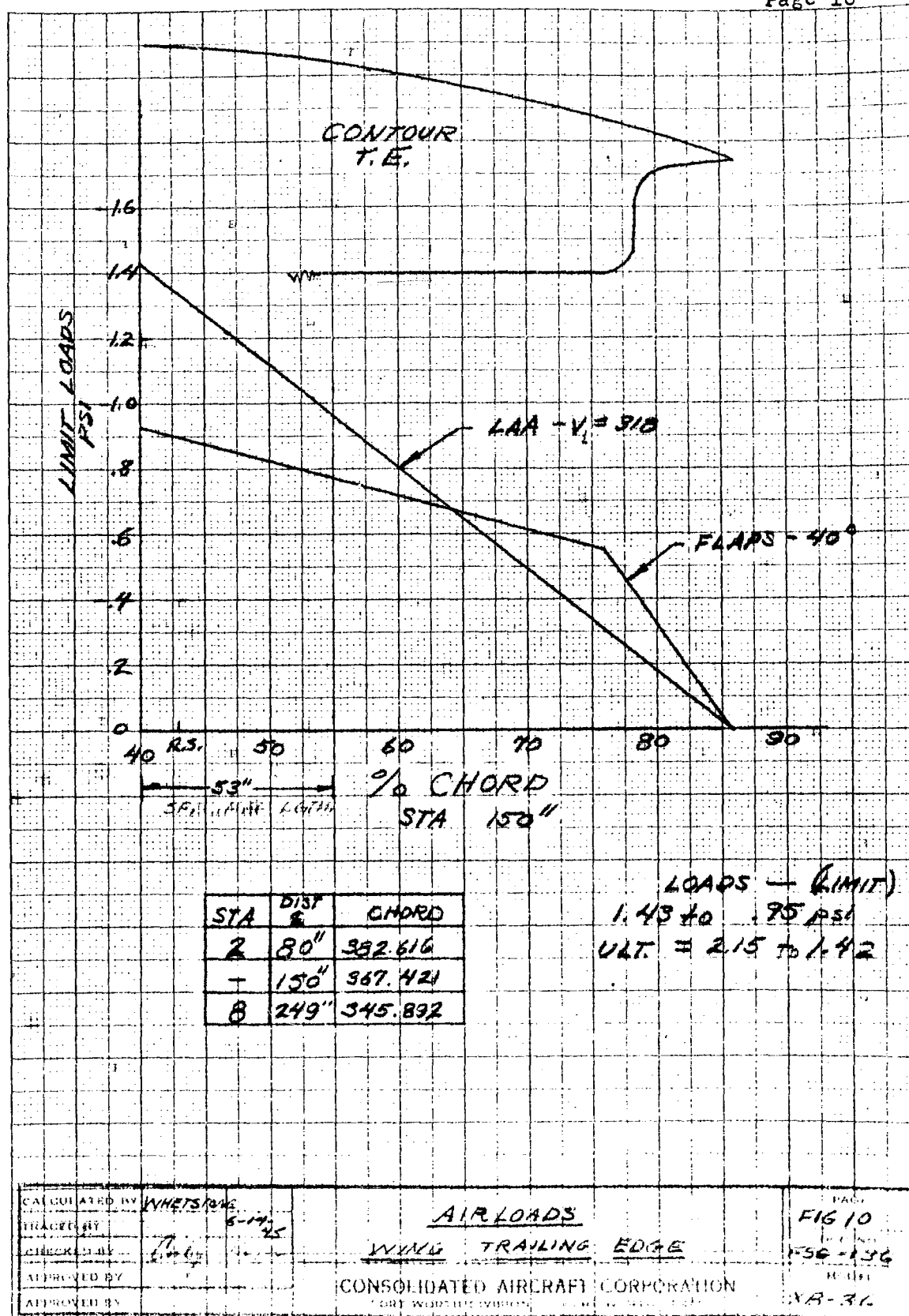


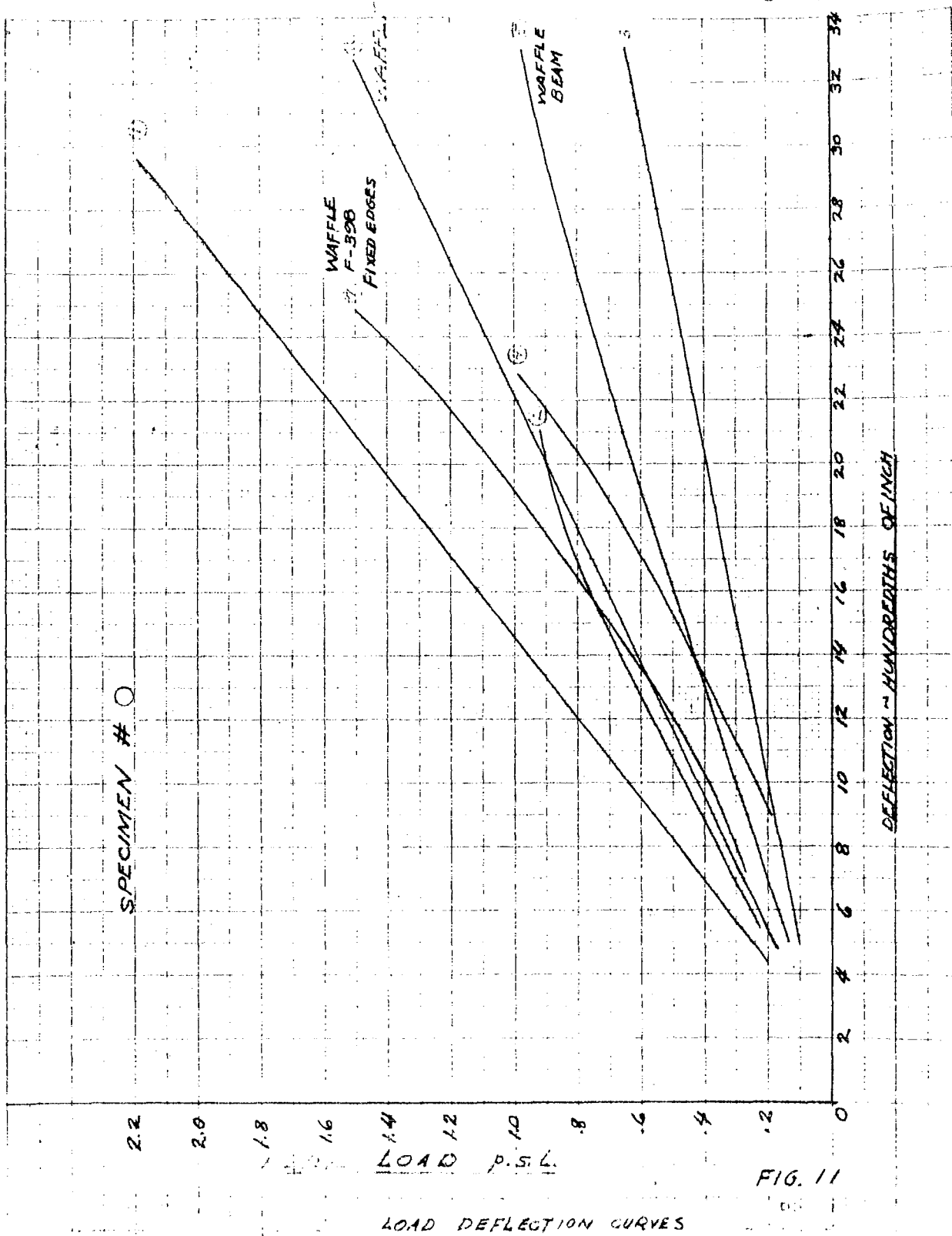
FIG. 8A







STATE OF TEXAS
COUNTY OF DALLAS
CIVIL DISTRICT COURT
IN RE: THE ESTATE OF
JAMES EARL RAY, JR.
DECEASED
JAMES EARL RAY, JR.
BY: JAMES EARL RAY, JR.
JAMES EARL RAY, JR.





MODEL YB-36A
TEST No. F-1632

REPORT FSG-136 Ad.1
DATE March 25, 1946

TITLE

WING - TRAILING EDGE SKIN PANELS - (MAGNESIUM WAFFLE SECTION) -
STATIC & DEFLECTION TEST

The tests described in this report were conducted
December 13, 1945

SUBMITTED UNDER

PREPARED BY:

J. Robinson

GROUP: ENGINEERING TEST LAB.

REFERENCE:

R. S. Leade

CHECKED BY:

J. T. Corby

APPROVED BY:

H. E. Robinson

NO. OF PAGES 8

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WING - TRAILING EDGE SKIN PANELS - (MAGNESIUM WAFFLE SECTION) -
STATIC & DEFLECTION TEST

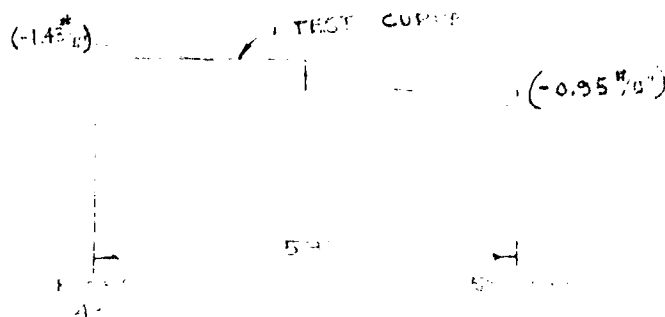
OBJECT & PURPOSE: To determine the strength of a skin panel using a metalbonded assembly of .025 magnesium (52 S0) waffle and .016" magnesium skin (52 SH); and to further compare the results of the test on the magnesium with that of the original panel with an .016 aluminum alloy waffle.

The magnesium waffle has an advantage over the aluminum alloy in that it is easier to form, thereby reducing the number of rejections; it also produces a smoother assembled panel.

TEST SPECIMEN: The details of the test specimen are shown in Figure 1, 36W2367, and Figure 2.

TEST SET-UP AND PROCEDURE: The test specimen was assembled to a steel jig, as shown in Figure 2, in such a manner as to duplicate as near as possible an assembly at wing Sta. #150 at the rear spar of the YB-36 airplane. This set-up was identical to the set-up used in testing the aluminum alloy panel (specimen #6 of the original report).

The simulated air loads were applied by means of tension patches glued to the skin side so as to produce a trapezoidal distribution at design yield as shown below in Figure 4. The original curve is obtained from $\Delta P/q$ curves for LAA ($V_t = 310$ mph.) condition.



Deflections were measured at the center of the panel, chord-wise and span wise.

TEST RESULTS: The deflections as measured during the test are recorded in Table I. These were further corrected for net deflections in the panel itself as shown in Table II and plotted in Figure 3.

ANALYSIS _____
PREPARED BY _____
CHECKED BY _____
REVISED BY _____

Consolidated Vultee Aircraft Corporation
FORT WORTH DIVISION
FORT WORTH, TEXAS

PAGE 2
REPORT NO. FSG-136 Ad.1
MODEL YB-36A F-1632
DATE March 25, 1946

WING - TRAILING EDGE SKIN PANELS - (MAGNESIUM WAFER SECTION) -
STATIC & DEFLECTION TEST

TEST RESULTS: (Continued)

Initial buckling occurred at 92% of the design ultimate load; however the specimen was able to carry the load to 134% of the design ultimate load as a catenary. A photograph of the specimen after the 134% increment is shown in Figure 4. The original aluminum alloy specimen buckled at 86% of the design ultimate load, and supported 114% of D.U.L. Neither specimen was tested to complete failure.

CONCLUSIONS: Since the specimen withstood the test load to 92% of the design ultimate load before initial buckling occurred and was further able to successfully carry the load to 134% of the design ultimate, it is considered structurally satisfactory for use as a trailing edge panel in the YB-36A airplane.

8/2/1942

DEFLECTIONS - MAGNESIUM WAFFLE

TABLE II

AVERAGE LOAD PSI	% DESIGN ULT. LOAD	DEFLECTION	
		.025 MAG. WAFFLE	.016 ALUM. WAFFLE
.18	10	.048	.051
.36	20	.110	.104
.54	30	.176	.152
.72	40	.251	.208
.90	50	.297	.248
1.19	66.7	.442	.330
0	0	.060	.070
.36	20	.163	-
.72	40	.283	-
1.19	66.7	.442	-
1.25	70	.470	-
1.43	80	.571	.415
1.61	90	.675	0

ANALYSIS

PREPARED BY

CHECKED BY

REVISID BY

Consolidated Vultee Aircraft Corporation

FORT WORTH DIVISION

FORT WORTH, TEXAS

PAGE

REPORT NO.

MODEL

DATE

8

FSG-136-Ad.1

YB-36A - F-1632

March 25, 1946

PHOTOGRAPHIC INDEX

<u>FIGURE NO.</u>	<u>PHOTO NO.</u>
FIGURE 1	
FIGURE 2	2-5438
FIGURE 4	2-5300

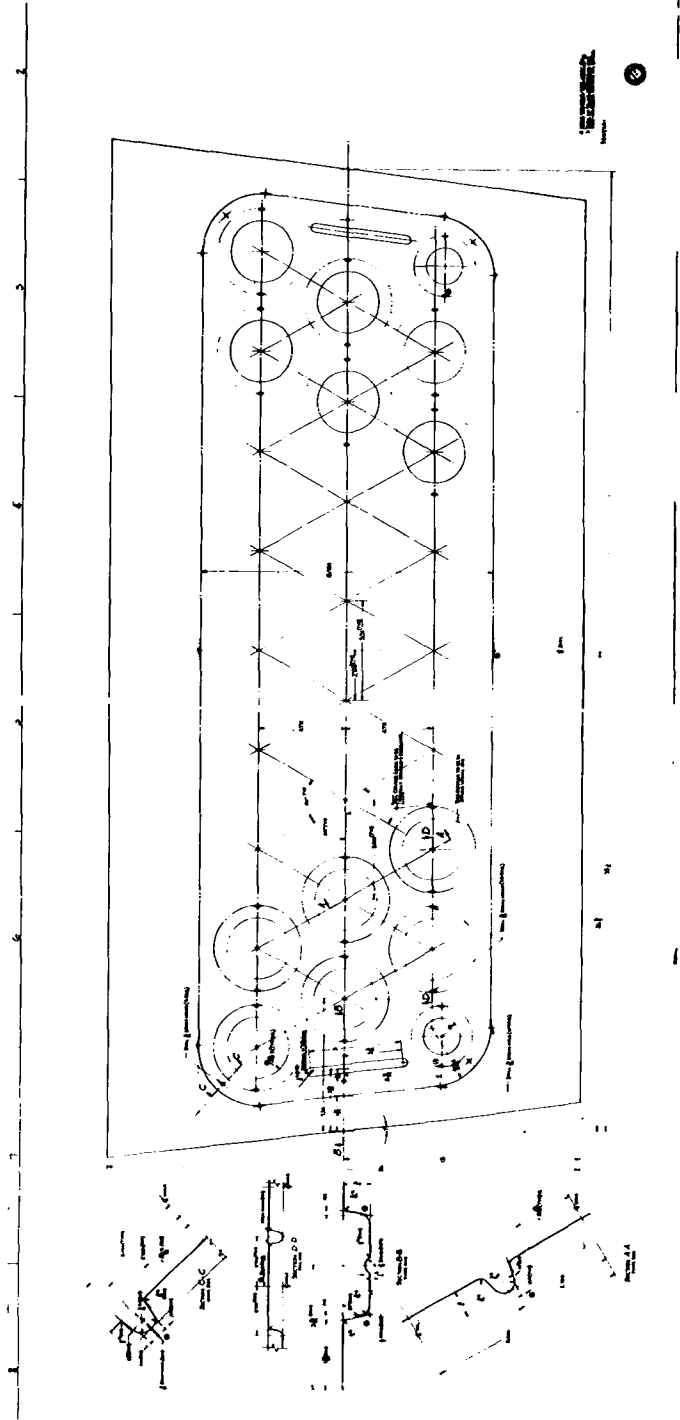
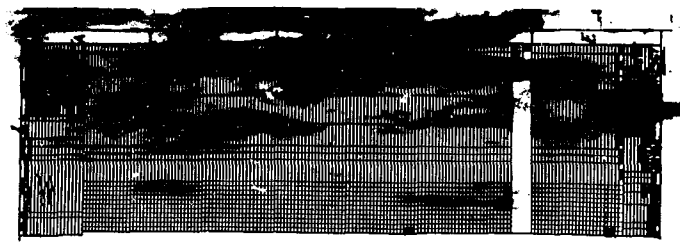
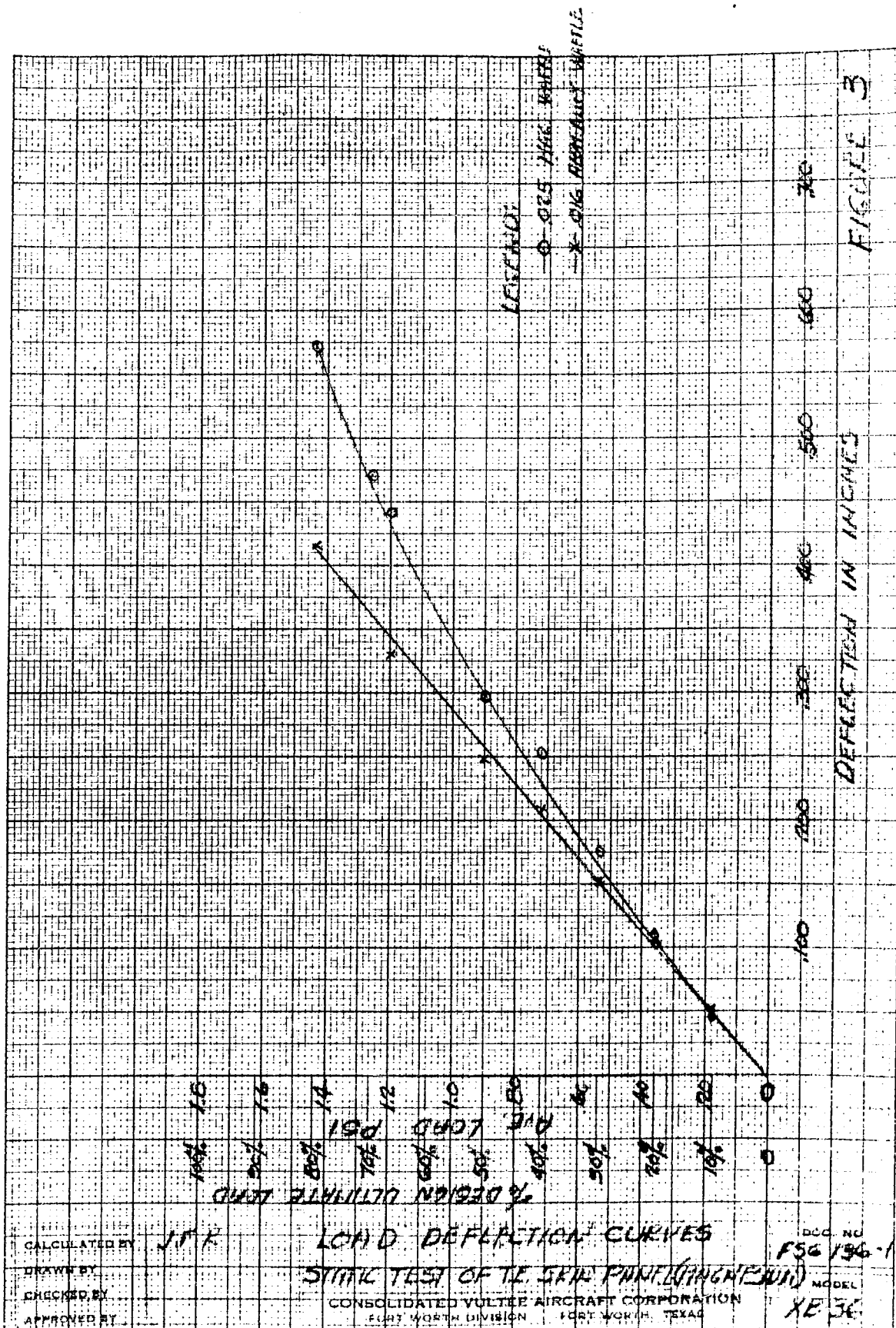
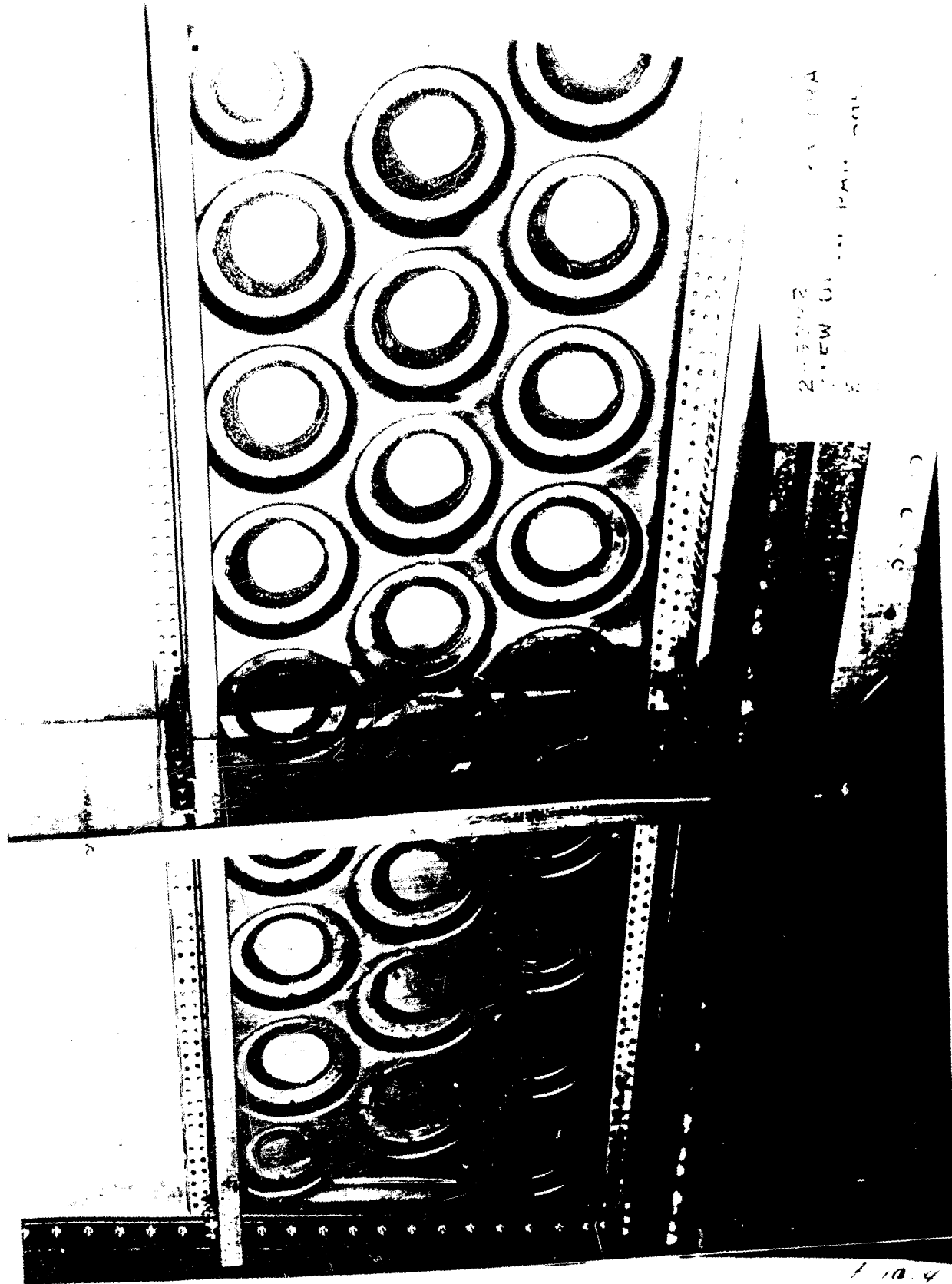


FIG. 1





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